Office of Science and Technology

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The Technology Management System,
available through the OST website,
provides information about
OST programs, technologies, and problems.

ASTD: Expediting DOE Site Cleanups

Accelerated Site Technology Deployment Program

Solving Problems, Building Partnerships, Accelerating Schedules, Saving Money, and Improving the Baseline

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U.S. Department of Energy
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Office of Science and Technology

The Need

To support the defense mission of the United States (U.S.), the U.S. Department of Energy (DOE) and its predecessor created large industrial complexes at many sites across the country to produce nuclear materials and weapons. Like many industrial operations, these facilities generated waste materials, which were hazardous or in this case also radioactive. These wastes were handled using industrial standards of the time. However, as a result of the forty to fifty years of production operations, widespread contamination of both the environment and the production facilities has occurred.

DOE-EM is focused on effective, safe, and cost-conscious remedies for its problems:

1) over 9000 release sites: 600 billion gallons of contaminated ground water and 50 million cubic meters of contaminated soil containing organic compounds, metals, and radionuclides;

2) 65 million square feet of facilities requiring decontamination and decommissioning (hazardous and radioactive contaminants);

3) high-level (>90 million gallons in underground storage tanks), low-level, mixed low-level and transuranic (1.8 million cubic meters) radioactive waste, and hazardous waste;

4) nuclear materials and spent nuclear fuels to be safely disposed.

Since 1989, DOE's Office of Environmental Management (EM) has been responsible for environmental restoration, waste management, and nuclear material and facility stabilization across the nuclear weapons complex. The complex is comprised of over one hundred sites in 30 states and Puerto Rico. Over the last ten years, EM has focused on identification of its problems and development of solutions, but much more work remains to be done.

Through its *Accelerating Cleanup: Paths to Closure* document (DOE/EM-0362) published in 1998, the EM program is now accelerating efforts to clean up these sites, while ensuring worker safety and health protection. Significant progress has been made: 60 sites have been cleaned up and 53 sites (353 projects) remained at the beginning of 1998 (DOE/EM-0362, 1998). The estimate for this cleanup, to be completed in 2070, is $147 billion (in 1998 dollars). Some of the current problems can be solved using today's existing baseline technology, but may require years of treatment to remediate a site. Some of the problems currently have no solutions.

The cleanup of these DOE facilities is currently being conducted under the auspices of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and Resource Conservation and Recovery Act (RCRA) and related state laws. Tri-party agreements between DOE, EPA, and the appropriate state have been signed at many of the larger facilities. Because many of DOE's problems are common to those experienced by other federal (e.g., Department of Defense [DOD]) and non-federal industrial sites, technology solutions benefit a broader audience. Some of the problems, especially those dealing with radioactive waste, are unique to DOE.

ASTD: A New Solution

- *DOE-EM established the ASTD Program in 1997 to provide a means and incentives to promote multi-site deployment of new technologies to accelerate cleanup at DOE sites.*

Because there is a need for less expensive and more efficient solutions, DOE established the Office of Science and Technology (OST) to investigate better methods and approaches to solving EM's problems. DOE-EM directed OST to establish an Accelerated Site Technology Deployment (ASTD) Program to support site needs to accelerate cleanup schedules, work within budget constraints, and fill gaps where current technologies do not exist to accomplish specific cleanup actions. The ASTD Program, originally known as the Technology Deployment Initiative (TDI), was initiated in 1997 to provide a means and incentives to promote multi-site deployment of new technologies and processes that can accelerate cleanup throughout the weapons complex.

ASTD is a *leveraged* program that encourages the deployment of newly proven technologies to accelerate DOE EM's schedules for site cleanup, while reducing costs for cleanup. ASTD projects are *customer driven* (embraced by the DOE Site Managers for EM) and thus *meet site needs* for improvements to the baseline. The ASTD Program acts as a catalyst for Site Managers to work closely with technology owners to provide innovative solutions that can expedite their cleanup program. The DOE Site Managers share the risk of trying a new technology with OST.

Barriers to trying new technologies are broken down through information transfer and sharing. Multiple site deployments of DOE-supported technologies improve DOE's *return on investment*.

What is ASTD?

- *ASTD incentivizes the use of new technologies to improve baseline methods*
- *ASTD is customer-driven*
- *ASTD promotes coordination across EM organizations*
- *ASTD encourages sites to share lessons learned*

How ASTD Works

Since 1997, OST has issued two calls for proposals under the competitively structured program. DOE Site Managers have submitted proposals for specific projects that include newly proven technology solutions that can accelerate their schedules, provide improved alternatives to the existing baseline, and save money. The proposals were reviewed and ranked by a broad stakeholder panel using a structured, criteria-driven process. Over the last two years, the ASTD Program has been reviewed by an external expert panel, the DOE Environmental Management Advisory Board, to validate program operation. In 1998, the panel found the competitive project selection process to be fair and well orchestrated.

Criteria that were specific to TDI (the first call) included a requirement for multiple site deployments and commitment. The second call, in late 1998, required the *site end user* need (through EM Integration Disposition Maps and/or *Paths to Closure)* to be identified in the proposal.

In 1999, ASTD is managed through the Focus Area-centered approach, which places full responsibility for all investments, science through deployment, under the management of the Focus Areas. The Focus Areas are now required to make the cleanup project manager an integral part of the Focus Areas' management and requires cleanup project manager approval of all projects. The intent of the Focus Area-centered approach is to make EM's science and technology investments solution oriented and an integral part of the cleanup. OST's Focus Areas are structured around DOE's problems: Subsurface Contaminants, Tanks, Mixed Waste, Deactivation and Decommissioning, and Nuclear Materials.

Criteria for selection of ASTD projects include:

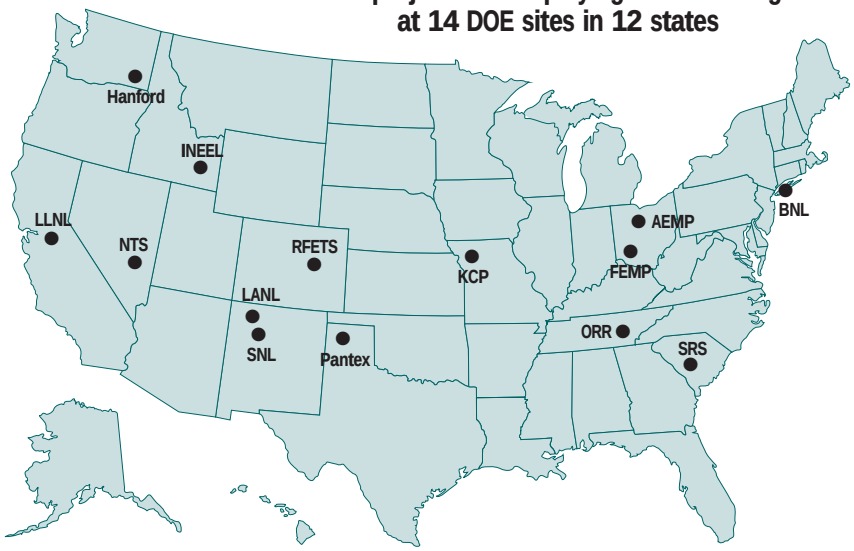
- *Demonstrated improvement over existing baseline*
- *Demonstrated technology performance and maturity*
- *Commitment by the Site Manager*
- *Leveraged funding between OST and EM*
- *Confidence of schedule demonstrating baseline acceleration or cost savings*
- *Cost benefit*
- *Ability to obtain the necessary regulatory permits*
- *Demonstrated ability to integrate site stakeholders*

More about ASTD

- *The ASTD Program is founded on a competitive selection process.*
- *The ASTD Program is reviewed by an external expert panel.*

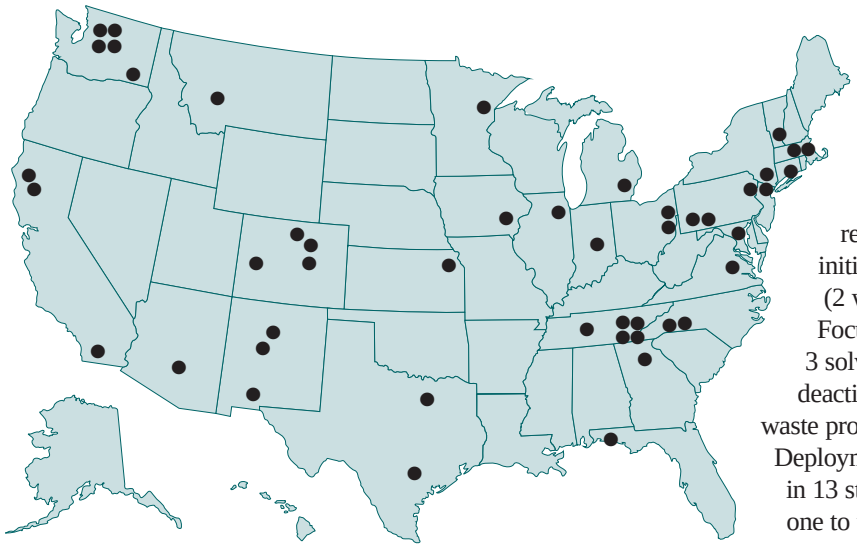
ASTD Project Summary

1998 projects are deploying 39 technologies at 14 DOE sites in 12 states



In 1998, 13 projects, consisting of 39 technologies, were initiated. Six of the projects solve problems dealing with subsurface contamination of soils and ground water, three address deactivation and decommissioning problems, and four focus on problems associated with the cleanup and closure of the high-level radioactive waste underground storage tanks. Deployments are occurring or have occurred at 14 DOE sites, located in 12 states. Projects are scheduled to last from one to three years. Industry, especially small businesses, are involved in all of these projects.

For the 1998 projects, over 60 businesses are providing products and services. Approximately two-thirds of these businesses are classified by the Small Business Administration as small businesses. They are located throughout the U.S. in 26 states.



Over 60 businesses (>$^2/_3$ small) from 47 cities in 26 states are providing products and services for the 1998 projects

In 1999, 42 additional projects, consisting of over 60 technologies, were selected for funding by the reviewers. Due to OST funding constraints, 32 have been initiated this year, whereas 8 others will be started next year (2 were cancelled). These projects fall within the following Focus Areas: 17 address subsurface contaminant problems, 3 solve underground storage tank problems, 9 focus on deactivation and decommissioning problems, 2 target mixed waste problems and one solves plutonium problems. Deployments are scheduled to occur at 15 DOE sites, located in 13 states. Projects are scheduled for completion within one to two years.

Year	# Proposals Received	# Proposals Selected	# Projects Initiated	OST $$
1998	89	20*	13	$27.0M
1999	50	42	32	$15.5M

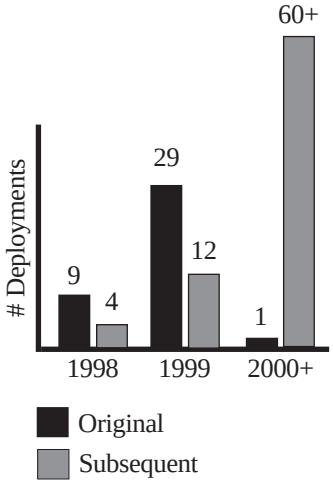
* Some proposals with similar technologies were combined into one project.

1998 Successes

A number of the 1998 projects support deployment of multiple technologies that have been integrated into systems to provide improved solutions to specific problems (e.g., *Integrated Technology Suite*, designed to map the radioactivity in soils). Several projects (e.g., *Sludge Retrieval System*) support a toolbox of technologies that can be deployed together or separately depending upon the specific application. Some of the projects include multiple site deployments under the ASTD Program (e.g., *Segmented Gate System*, a system that sorts radioactive soils with the goal of volume reduction, was deployed at 4 sites in 1998); while others plan on subsequent deployments funded through other programs.

Thirteen deployments at nine DOE sites occurred under 6 of the 13 projects during the first year (1998). During the second year of the program (1999), the thirteen projects will achieve 41 additional deployments. In 2000, one original deployment will occur plus more than 60 potential or planned subsequent deployments have been identified through improved site-to-site communication mechanisms.

Planned and Potential Deployments (Original & Subsequent) by Year: 1998 Projects



1998 Highlights

- ***Improvements to site baselines have been made.*** The Modular Evaporator/ Cesium Removal System, which treats high-level or high-activity liquid radioactive waste, is now being integrated into the Oak Ridge baseline as a result of successful demonstrations and deployments. The technology is also planned for deployment at the Savannah River Site Defense Waste Processing Facility and the Consolidated Incineration Facility.

- ***Technologies are being deployed at multiple sites.*** The Segmented Gate System, which reduces the volume of radioactively contaminated soils that require disposal, was deployed at *four* DOE sites in one year under ASTD! At Sandia National Laboratories Environmental Restoration 16 Site, it was deployed for the fifth time in 1998 under an EM Environmental Restoration funded program, where *cost savings of $280,000* were incurred after 662 cubic yards of soil were processed.

- ***Cost savings are being realized as new technologies are replacing the baseline technologies.*** At Kansas City Plant, a permeable reactive barrier (passive iron treatment wall) was installed to replace a pump-and-treat system that had been operating for 10 years. The pump-and-treat system has been expensive to maintain and operate. The permeable reactive barrier requires no external energy source, no daily operation and maintenance, produces no secondary waste stream, and reduces the long-term mortgage. The life-cycle *cost savings* are *estimated at about $30 million* at the Kansas City Plant. Permeable reactive barriers are being installed at *four* other locations in the DOE complex and many other sites are considering this technology option.

- ***Partnerships between DOE sites with common problems were built.*** The Slurry Monitoring Project, which supports technologies to monitor operations of waste retrieval from underground storage tanks, has been based on a team effort between Hanford and Oak Ridge. Hanford personnel have provided calibration support, whereas Oak Ridge is the actual deployment site. Future deployments are anticipated at both Hanford and the Savannah River Site.

The Successes:

- *Technologies are being integrated into site operations, improving the baseline, accelerating schedules, and saving money*
- *ASTD has catalyzed partnerships between technology owners and site end users so new technologies meet user needs*
- *ASTD has promoted site-to-site communication and sharing of lessons learned*
- *Technologies are being integrated into systems*
- *Technologies are filling gaps*
- *Technologies are being deployed at multiple sites, improving DOE's return on investment*

- ***Technologies are being integrated into systems.*** The Integrated Technology Suite combines three characterization technologies to provide a real-time mapping product that enhances our understanding of the distribution of radioactive contamination in soils. This system has been deployed at Fernald at *four* different locations to optimize soil excavation operations. Because it is a real-time technology, fewer samples must be sent to the laboratory and field operations can be optimized based upon the quick turn-around time. The amount of soil requiring excavation and disposal can then be minimized, thereby further reducing costs.

- ***Site cleanup schedules are being accelerated.*** The Integrated Technology Suite, described above, has accelerated soil excavation operations at Fernald by six years.

- ***Technologies are filling gaps that previously didn't have solutions.*** The Slurry Monitoring System, described above can provide critical information during waste retrieval operations for the underground storage tanks at Hanford, Oak Ridge, Idaho National Engineering and Environmental Laboratory, and the Savannah River Site. The type of data being collected was previously not available and yet the technology can save millions of dollars because it can prevent plugging of transfer lines and shut-down of retrieval operations.

- ***Sites are sharing lessons learned by enhancing communications.*** The Segmented Gate System (SGS) project has assembled a team of users and providers at sites where the technology has been deployed and sites with potential for deployment. They are meeting frequently to optimize the application of SGS.

Hydrous Pyrolysis/ Dynamic Underground Stripping

- *HP/DUS treats ground water and soils contaminated with organics*
- *HP/DUS can replace pump and treat, dramatically reducing the time required for cleanup.*
- *HP/DUS is being deployed at three DOE sites: PORTS, SRS, and LLNL*
- *HP/DUS can be used at many DOE sites, other Federal sites, and industrial sites.*
- *HP/DUS is estimated to save >$100 M at the three DOE sites.*

1999 ASTD Sample Projects

In FY 1999, ASTD has begun 32 new projects, some of which have tremendous potential for cost savings and schedule acceleration within the DOE complex and beyond at DoD and other sites. Over 30 technology deployments are anticipated in 1999 under these new projects. Descriptions of several projects with great potential for significant DOE impact follow.

Hydrous Pyrolysis/Dynamic Underground Stripping (HP/DUS) [TMS #1519 and 7]

Dynamic Underground Stripping technology was used at Lawrence Livermore National Laboratory in 1992 to clean up a small plume of soils and ground water contaminated with gasoline by injecting steam and adding heat to the contaminant zone. The technology was selected as an alternative to a pump-and-treat system. The technology was enhanced (addition of Hydrous Pyrolysis) and modified for deployment at the Consolidated Edison Visalia site in California. The site, a former wood-treating facility, is contaminated with heavy petroleum hydrocarbons, such as creosote. The Hydrous Pyrolysis/Dynamic Underground Stripping technology has significantly reduced the time of cleanup of soils and ground water at the Visalia site, after a pump-and treat-system was found to be ineffectual over a number of years. Cost savings are estimated to be $20 million at this site and time for cleanup has been dramatically reduced.

Hydrous Pyrolysis/Dynamic Underground Stripping deployed at Visalia California site.

This technology has great potential to compress cleanup schedules at numerous sites, both DOE and beyond, contaminated with organic compounds from 30 to 100 years to less than five years. It is currently being deployed under ASTD at the Portsmouth Ohio facility; it will be deployed later this year at the Savannah River Site in South Carolina and at the Lawrence Livermore National Laboratory in California. All three sites are contaminated with dense non-aqueous phase liquids (DNAPLs) in the subsurface. Estimated cost savings to be realized by deploying this technology in place of pump and treat at the three DOE sites are greater than $100 million.

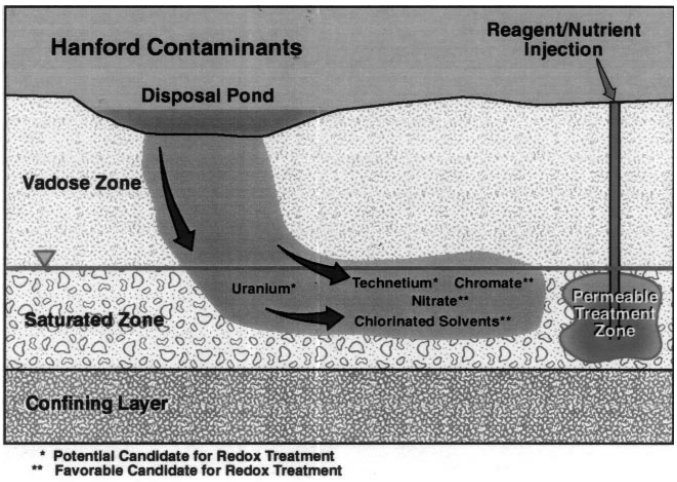
In Situ Redox Manipulation

- *ISRM treats ground water contaminated with inorganic wastes, e.g., metals.*
- *ISRM can replace pump and treat, dramatically reducing the time required for cleanup.*
- *ISRM can be used at DOE, other Federal, and industrial sites.*
- *ISRM is estimated to save over $11.5M at Hanford over the next 10 years.*

In Situ Redox Manipulation (ISRM) [TMS #15]

In Situ Redox Manipulation has been demonstrated at the DOE Hanford Site (100-D Area) to treat ground water contaminated with chromium. The successful demonstration, funded by the Subsurface Contaminants Focus Area, led to a proposal from the Hanford Site 100-D Area Site Manager to utilize this technology as a remedial option for the full chromium plume. A line of injection wells will be installed along the leading edge of the plume to intercept and treat the ground water before it enters the Columbia River. The line of injection wells creates a permeable barrier through which the ground water flows for in situ treatment, as a reducing dithionite solution is injected. The technology's advantages include in situ treatment (no costs for pumping the ground water to the surface for treatment and accompanying waste disposal), less environmental health impact to workers (contaminants are not pumped to the surface), and lower costs for installation, operations, and maintenance. Estimated cost savings for deploying this technology as an alternative to pump and treat over a ten-year period are $11.5 million.

In Situ Redox Manipulation Concept



This technology can be applied at many other DOE and non-DOE sites that are contaminated with metals whose mobility is controlled by oxidation-reduction reactions. Such metals include chromium, uranium, technetium, lead, cadmium, and iron.

The Bottom Line

ASTD is building partnerships to incentivize deployment of previously demonstrated technologies that meet needs identified at DOE sites by site managers. Multi-site cooperation is improving DOE's return on investment while accelerating cleanup schedules. DOE has found a new way to do business that ensures getting the job done faster, safer, and cheaper. ASTD continues to demonstrate that it provides value added to the EM cleanup effort by delivering newly proven technologies that are ready for deployment and that save money and time for cleanup.